DISTRIBUTION AND DEMOGRAPHY OF DIURNAL PRIMATES IN SILENT VALLEY NATIONAL PARK AND ADJACENT AREAS, KERALA, INDIA[1]

K.K. Ramachandran and Gigi K. Joseph[2]

Key words: Distribution, demography, *Macaca silenus*, *Trachypithecus johnii*, *Macaca radiata*, *Semnopithecus entellus*

Distribution and demography of all diurnal primates were studied in Silent Valley National Park and adjacent areas for a period of three years from 1993 to 1996. Fourteen troops of lion-tailed macaque, eighty-five troops of Nilgiri langur, fifteen troops of bonnet macaque and seven troops of Hanuman langur were observed. Of these, the Nilgiri langur was randomly distributed, whereas the lion-tailed macaque troops were confined to the southern sector of the Park. Bonnet macaques and Hanuman langurs were occasional visitors, especially during summer and northeast monsoon in the southwestern fringes of the National Park. Demographical studies revealed that the Silent Valley forest remains one of the most undisturbed viable habitats left for the endemic and endangered primates of the Western Ghats like the lion-tailed macaque and Nilgiri langur.

Introduction

India is well known for its rich primate fauna with as many as 15 species. These include seven macaque, five langur, two loris, and one ape species (Agrawal, 1998). The highest number of primate species in India is seen in the northeastern states, where 10 species occur in sympatry (Molur *et al.* 1998). The distribution of these primates very often extends to the Southeast Asian countries like Bangladesh, Myanmar, Indonesia, Thailand and South China. But the two endemic primates of the Western Ghats, namely lion-tailed macaque (*Macaca silenus*) and Nilgiri langur (*Trachypithecus johnii*), exist in the wild only in the south Indian states of Kerala, Karnataka and Tamil Nadu. Slender loris (*Loris tardigradus*), Hanuman langur (*Semnopithecus entellus*) and bonnet macaque (*Macaca radiata*) are also distributed in the state of Kerala.

In the last two centuries, up to 1970, extensive forest destruction for plantations and agriculture, and poaching severely affected the primate population in the Kerala part of the Western Ghats. However, the inclusion of vast stretches of forests in the protected area network, and the implementation of the Wildlife (Protection) Act in 1972, has helped to restore populations to some extent in many areas. Silent Valley National Park is still among the least disturbed evergreen forests in the country and it is important to estimate and monitor the primate populations there.

A number of studies have mentioned the status and distribution of primates in Silent Valley forests (Daniel and Kannan 1967, Kurup, 1975 1978, Roonwal and Mohnot 1977, Green and Minkowski 1977, Ali 1985, Easa *et al.* 1997). But it was Vijayan and Balakrishnan (1977) who first studied the mammalia exclusively in the rainforest ecosystem of the Silent Valley, in connection with a study on the impact of the hydroelectric project on wildlife. Later, Balakrishnan (1984) documented the need for conserving these rainforests, as it formed an important habitat of many larger mammals. Though some recent studies (Ramachandran 1990, Joseph 1998, Joseph and Ramachandran 1998) have described the distribution, status and

[1]Accepted August, 2000
[2]Division of Wildlife Biology,
Kerala Forest Research Institute,
Peechi, Kerala 680 653, India.

demography of lion-tailed macaque, no detailed work was done on other primates, especially after the declaration of the National Park in 1984. The present paper deals with the distribution and demography of all diurnal primates in Silent Valley National Park and adjacent areas.

Study area

The Silent Valley National Park is situated in Palghat district, Kerala (11° 3' to 11° 13' N and 76° 21' to 76° 35' E). It is one of the core areas of the Nilgiri Biosphere Reserve. The National Park extends over 90 sq. km and has pure evergreen vegetation. Kunthipuzha, a tributary of Bharathapuzha, originating from the northeastern hill ranges of the National Park, drains the area. The altitude varies between 658 to 2,383 m. Silent Valley forests receive some of the highest rainfall in the entire Western Ghats, with an average of 6,000 mm per year. The annual mean temperature is *c.* 20 °C.

The highly diverse flora of Silent Valley consists of 966 species belonging to 134 families and 559 genera (Manilal 1988). This comprises 701 dicotyledons and 265 monocotyledons. The five dominant families recorded are: Orchidaceae, Poaceae, Fabaceae, Rubiaceae and Asteraceae. Relative abundance of certain species in specific patches has resulted in the formation of certain tree associations. Six distinct tree associations can be distinguished in the Valley, and they are:- i) *Cullenia exarillata-Palaquium ellipticum*, ii) *Palaquium ellipticum-Mesua ferrea*, iii) *Mesua ferrea-Calophyllum elatum*, iv) *Palaquium ellipticum-Poeciloneuron indicum*, v) *Calophyllum elatum-Ochlandra* sp. vi) *Poeciloneuron indicum-Ochlandra* sp. Among these, the first three tree associations are restricted in the southern sector, whereas the rest of them are confined to the central and northern parts of the National Park (Aiyar 1932).

Methods

Distribution and demography of primates were studied in the National Park and adjacent areas for three years from 1993 to 1996, as part of the endangered primate research project. The National Park and the adjacent areas, were stratified into 12 major blocks of average 10 sq. km area. As the troops of each primate species were not randomly distributed in the highly undulating terrain, line transect method of estimating the animal population (Burnham *et al.*, 1980) was found unsuitable. So total count and sweep sampling methods were used (NRC 1981, Whitesides *et al.* 1988). Repeated surveys were conducted on foot in each of the blocks to count troop size, structure and sex ratio. Individuals of each species were classified into five categories based on the morphological differences as recorded in literature (Poirier 1969, Roonwal and Mohnot 1977, Kumar 1987, Joseph 1998).

Results

Lion-tailed macaque (*Macaca silenus*)

Fourteen troops of lion-tailed macaque were identified from Silent Valley National Park and adjacent areas (Table 1). The troops tended to be distributed towards the southern side of the Park, in specific tree association areas such as *Cullenia-Palaquium*, *Palaquium-Mesua* and *Mesua-Calophyllum* prevailing in the evergreen habitat. They were seen in Sairandri, Puchappara and Nilikkal sections within the Park and Panthenthod section of the Attappady reserve forests. A preference for altitudes between 700 and 1,500 m was observed. A total of 275 individuals were observed with an average troop size of 19.64 individuals. The troop size varied from 9 to 36 individuals. The population consisted of more adults (53%) than immatures (47%). The adult sex ratio (1:5.63) was strongly in favour of females (Table 2).

TABLE 1
POPULATION STRUCTURE OF PRIMATE COMMUNITY IN SILENT VALLEY NATIONAL PARK AND ADJACENT AREAS

Species	Number of troop sightings	Total individuals sighted	Number of troops estimated	Estimated population size	Average troop size	Troop size range
LTM	1,793	6,398	14	275	19.64	9-36
NL	1,410	5,418	85	501	5.89	1-14
BM	66	531	15	192	12.8	5-30
HL	25	63	7	24	3.4	1-6

LTM = Lion-tailed macaque, NL = Nilgiri langur, BM = Bonnet macaque, HL = Hanuman langur

Nilgiri langur (*Trachypithecus johnii*)

Unlike the lion-tailed macaque, the Nilgiri langur had a wide range of distribution from 400 to 2,300 m elevation in and around the Silent Valley National Park. Though there is variation in the tree associations of different locations, the distribution of this arboreal species was observed in all tree associations of the Park A total of 5,418 individuals, from 1,410 troop records were observed (Table 1). Eighty-five troops were identified from the overall troop sightings. A total of 501 individuals were observed with an average troop size of 5.89 individuals. Of these, 20.16% were adult males and 40.12% were adult females. The gender of 5.19% of the adults could not be determined, and the rest of the population constituted immature langurs. The adult male-female ratio estimated was1:1.99.

Bonnet macaque (*Macaca radiata*)

Most of the bonnet macaque sightings were concentrated in the southern fringes of moist deciduous forests bordering the National Park. However, they were observed in the evergreen areas inside the Park during the summer and northeast monsoon. Bonnets were sighted in Sairandri, Aruvampara, Punnamala, Parathod, Panthenthod, Chembotty, Nilikkal, and Walakkad areas. A total of fifteen troops were identified, having 192 individuals altogether (Table 1). The average troop size was 12.8 individuals, varying from five to thirty individuals. Percentage composition of adult males was 11.45% and of the adult females 31.25%. The adult male-female ratio was 1:2.72 (Table 2).

Hanuman langur (*Semnopithecus entellus*)

Hanuman langur troops were commonly seen in the moist deciduous forests of Mannarghat Forest Division bordering the southern region of the National Park. Many a time, they were seen foraging solitarily or along with Nilgiri langurs in the evergreen areas,

TABLE 2
AGE-SEX COMPOSITION OF PRIMATES IN SILENT VALLEY

Species	Adult male	Adult female	Unidentified adult	Immature	Adult male-female ratio
LTM	22	124	-	129	1:5.63
NL	101	201	26	173	1:1.99
BM	22	60	52	58	1:2.72
HL	5	9	1	9	1:1.8

LTM = Lion-tailed macaque, NL = Nilgiri langur, BM = Bonnet macaque, HL = Hanuman langur

especially in October and November. Their occasional visit to the evergreen forests was found to be limited to the peripheral regions of *Cullenia-Palaquium* tree association patches, notably in the Nilikkal area. Once a solitary Hanuman langur was sighted in the Aruvampara region east of Kunthipuzha river. Out of the total sightings, seven troops were identified having 24 individuals (Table 1). Average troop size estimated was 3.4 individuals. Among the total individuals observed 20.8% were adult males and 37.5% were adult females (Table 2). The percent composition of immature was 37.4%, while the gender of 4.1% of the adults could not be determined.

Discussion

The study reveals the existence of a healthy population of lion-tailed macaque and Nilgiri langur thriving in the Silent Valley National Park and adjacent areas. The extensive habitat continuity of the evergreen forests with least human interference help to establish an interbreeding primate population. Most of the lion-tailed macaque troops in the Western Ghats exist as small populations due to extensive fragmentation of the rainforest habitat. These small populations often undergo random shifts in size naturally or due to human influence. Such events can cause a dramatic shift, and can be destructive to the population, even leading to local extinction. Out of the total population of lion-tailed macaque, the Kerala part of Western Ghats hoids more than 50% and the rest is shared between Karnataka and Tamil Nadu (Kumar *et al.*, 1995). The Silent Valley population having 14 troops with 275 individuals remains one of the most important populations in its entire range. Modelling and simulation exercises were done using the same data, and it was found that the population is viable, facing no serious threats in the next 100 years (Lacy *et al.* 1996).

Though a healthy viable population of lion-tailed macaque is present in the study area, its distribution is more common in the *Cullenia-Palaquium* tree association areas, which provides ample food supply throughout the year. The *Poeciloneuron-Ochlandra* association patches in the higher elevations lack many of the food species of the highly arboreal lion-tailed macaque. This may be the reason for its absence in the upper reaches of Silent Valley National Park. Though the major ecological niche of the Nilgiri langur is the high altitude (1,600-1,900 m) montane shola, they have survived well in the low altitude (400-800 m) evergreen, semi evergreen and even moist deciduous habitats adjacent to the National Park. This is the most common folivorous primate distributed throughout the Park, irrespective of the various tree associations.

The primate community in Silent Valley constitutes four diurnal species, of which the bonnet macaque and Hanuman langur are not very common inside the Park. Bonnets are occasional visitors, preferring the summer and post monsoon, as there is higher availability of food in the evergreen areas during these seasons. The summer months have abundant *Syzygium* fruits, while in the monsoon, there is cauliflorous flowering of *Cullenia exarillata,* which was observed to be a favourite food item for all the four primates and the Malabar giant squirrel, *Ratufa indica*. Hanuman langur troops were common in the Mannarkad Reserve Forest bordering the western region of the Park, their range extends from the lower altitude moist deciduous areas to the comparatively high altitude evergreen areas. During the *Cullenia* flowering season, Hanuman langur has been reported from the Park for the first time. Many a time, Nilgiri langurs were sighted along with the Hanuman langur troops in moist deciduous areas. There is, therefore, a need for genetic studies to verify whether both interbreed in the southwestern region of the National Park.

Attappady Reserve Forest (RF), located adjacent to the National Park, has low lying evergreen forests with great conservation value. The present study reveals a population of lion-tailed macaque, Nilgiri langur and bonnet macaque thriving especially in the Panthenthod areas which is part of the Attappady RF. This area suffers more human interference than other areas inside the National Park. Trapping of nine lion-tailed macaque individuals from a troop inhabiting these areas by Muduga tribals during the study period itself is a clear instance of poaching. The whole area of Silent Valley National Park is treated as 'core zone'. There is a need for demarcating a buffer zone for the Park, which should also include the floristically and faunistically rich Attappady RF, particularly the Panthenthod area.

ACKNOWLEDGEMENTS

We thank Dr. J. K. Sharma, Director, KFRI for encouragement and the Wildlife Wing of the Kerala Forest Department for funding the primate research project in Silent Valley National Park.

REFERENCES

AGRAWAL, V.C. (1998): Faunal diversity in India: Mammalia. *In*: Faunal Diversity in India. Alfred, J.R.B., A.K. Das & A.K. Sanyal (Eds.), Envis Centre, Zoological Survey of India, Calcutta. pp. 459-469.

AIYAR, T.V.V. (1932): The sholas of the Palghat division — A study in the ecology and silviculture of the tropical rain forests of Western Ghats. *Indian Forester 58*: 414-432.

ALI, R. (1985): An overview of the status and distribution of the lion-tailed macaque. *In*: The Lion-tailed Macaque: Status and Conservation. Heltne, P.G. (ed.), Alan R. Liss, New York. pp. 1325.

BALAKRISHNAN, M. (1984): The larger mammals and their endangered habitats in Silent Valley forests in South India. *Biol. Conserv. 29(3)*: 277-286.

BURNHAM, K.P., D.R. ANDERSON & J.L. LAAKE (1980): Estimation of density from line transect sampling of biological populations. *Wildl. Monogr. 72*: 202.

DANIEL, J.C. & P. KANNAN (1967): Status of Nilgiri langur (*Presbytis johnii*) and lion-tailed macaque (*Macaca silenus*) in South India, Report. Bombay Natural History Society. pp. 1-9.

EASA, P.S., S. ASARI & S.C. BASHA (1997): Status and distribution of the endangered lion-tailed macaque (*Macaca silenus*) in southern Western Ghats, India. *Biol. Conserv. 80*: 33-37.

GREEN, S. & K. MINKOWSKI (1977): The lion-tailed monkey and its South Indian rainforest habitat. *In*: Primate Conservation. Prince Rainier III and G.H. Bourne (Eds) New York, Academic Press, pp. 289-337.

JOSEPH, G.K. (1998): Ecology of lion-tailed macaque (*Macaca silenus*) in tropical forests of Southern Western Ghats, India. Ph.D. thesis, FRI Deemed University, Dehra Dun.

JOSEPH, G.K. & K.K. RAMACHANDRAN (1998): Recent population trends and management of lion-tailed macaque (*Macaca silenus*) in Silent Valley National Park, Kerala, India. *Indian Forester 124*: 833-840.

KUMAR, A. (1987): The ecology and population dynamics of the lion-tailed macaque (*Macaca silenus*) in South India. Ph.D. thesis, University of Cambridge.

KUMAR, A., S. MOLUR & S. WALKER (1995): Lion-tailed macaque (*Macaca silenus*) Population and Habitat Viability Analysis Workshop-Report. Zoo Outreach Organisation, Coimbatore.

KURUP, G.U. (1975): Status of Nilgiri langur, *Presbytis johnii*, in the Anamalai, Cardamom and Nilgiri Hills of the Western Ghats, India. *J. Bombay nat. Hist. Soc. 65*: 283-292.

KURUP, G.U. (1978): Distribution, habitat and status survey of the lion-tailed macaque, (*Macaca silenus*) (Linnaeus). *J. Bombay nat. Hist. Soc. 75*: 321-340.

LACY, R., J. BALLOU & S. MOLUR (1996): Small population biology and the tools of recovery. *In situ report. Zoos' Print 11*: 9-23.

MANILAL, K.S. (1988): Flora of Silent Valley. The Mathrubhumi Press, Calicut. pp. 1-398.

MOLUR, S., P.O. NAMEER & S. WALKER (EDS) (1998): Conservation Assessment and Management Plan (CAMP) Workshop Report: Mammals of India. Zoo Outreach Organisation/CBSG, India, Coimbatore.

NATIONAL RESEARCH COUNCIL (NRC) (1981): Subcommittee on Conservation of Natural Populations, Committee on Nonhuman Primates. Techniques for the Study of Primate Population Ecology. National Academy Press, Washington, D.C.

POIRIER, F.E. (1969): The Nilgiri langur (*Presbytis johnii*)

troop: Its composition, structure, function and change. *Folia primat. 10*: 20-47.

RAMACHANDRAN, K.K. (1990): Feeding and ranging patterns of lion-tailed macaque in Silent Valley National Park. *In*: Ecological studies and long-term monitoring of biological processes in Silent Valley National Park. KFRI Research Report. pp. 109-133.

ROONWAL, M.L. & S.M MOHNOT (1977): Primates of South Asia: Ecology, Sociobiology and Behaviour. Cambridge, Massachusetts: Harvard University Press.

VIJAYAN, V.S. & M. BALAKRISHNAN (1977): Impact of hydroelectric project on wildlife. Report of the first phase of study. KFRI Interim Research report.

WHITESIDES, GA, G.H. OATES., S.M GREEN & R.P. KLUBERDANG (1988): Estimating primate from transect in a West African Rain Forest. A composition of techniques. *J. Anim. Ecol. 57*: 345-367.

■ ■ ■